

Lithium Thin Film System Design Review

Presented to Jerry Nolen

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***Argonne National Laboratory
Operated by The University of Chicago
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Design Review Outline

- **Design Requirements**
- **Functional Requirements**
- **Operating Parameter Envelope (Li)**
- **System Schematic and Heater Zones**
- **Status of Drawings**
- **Status of Procurements**
- **Status of Experimental Area in 370**
- **Fabrication Outlook**
- **ES&H**

Top Level Design Requirements for Lithium Thin Film System

Minimize lithium inventory

Compact system design

Materials of construction

SS, Fe, Ta, Mo, Nb, Be, W

Mechanical joint designs, sealing materials

Grayloc®, Cajon®, Conflat w/soft iron gaskets, SS o-rings

Maintain low pressure argon (or other inert) cover gas above Li free surface

Primary pressure boundary sealed by welding where possible

Secondary containment of lithium system

Top Level Functional Requirements

Enable thin film R&D with various fluids:

- Lithium
- Water
- Possibly others:
 - Ga
 - FC3283

Argon pressure driven flow to:

- Handle all above fluids
- Eliminate immediate need for pump
- Allow wide range of flow conditions

Nozzle assembly:

- Nozzle easily removable (only performed at room temperature for Li)
- Minimize quantity of Li requiring disposal as part of nozzle change out
- Allow coarse adjustment of impingement angle wrt plate +/- TBD°
- At operating temperature:
 - Allow easy fine adjustment of impingement angle wrt plate +/- 5°
 - Allow easy adjustment of distance between nozzle exit & impingement plate

Allow visual observation of film

- Digital still & video cameras

Instrumentation:

- TCs
- Sight glass for ΔP vs flow calibration (not used with Li)
- Gas pressure transducer
- Vacuum gauges
- Electron gun film thickness system (developmental)

Allow testing of rotating disk as a possible means of

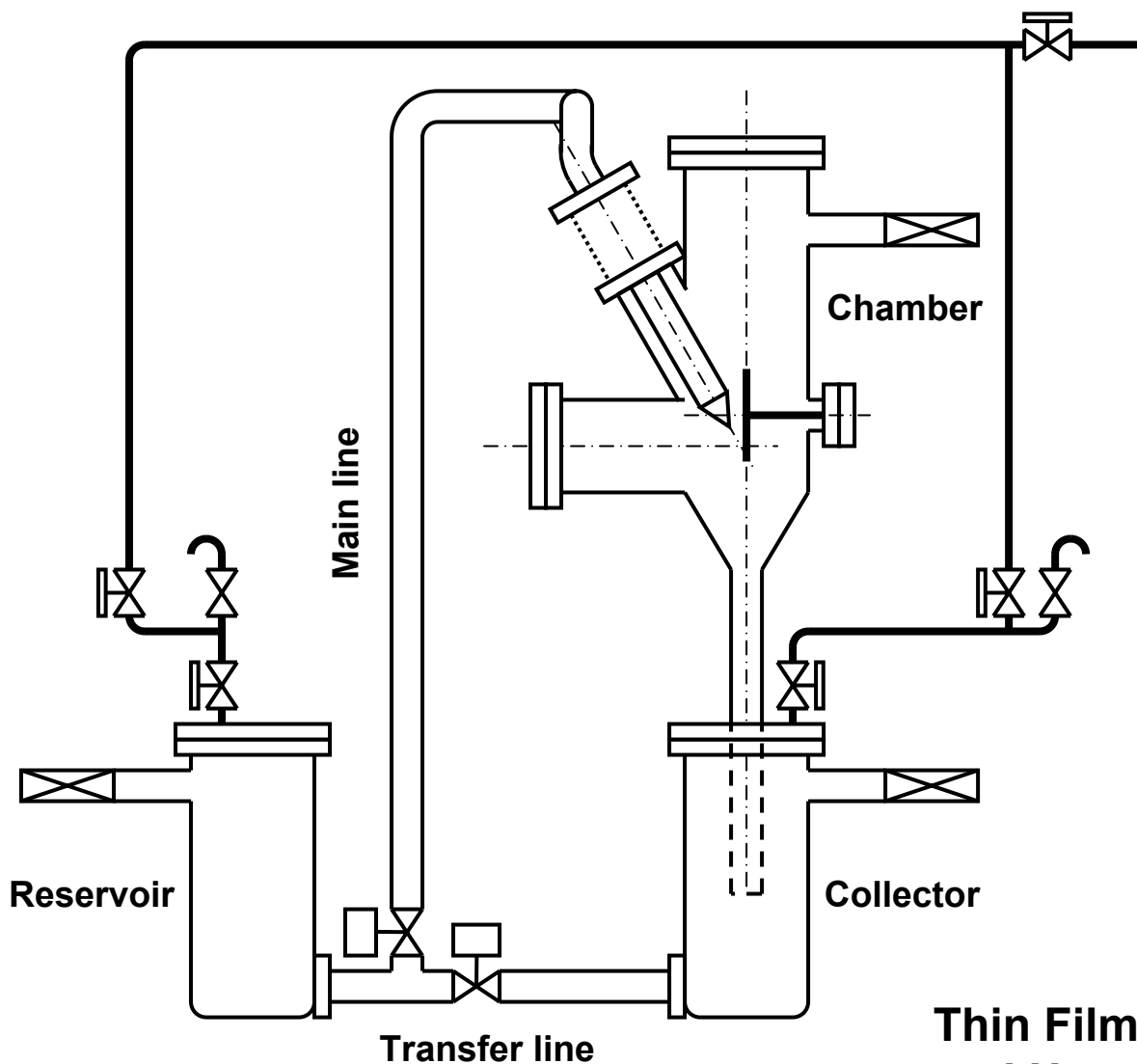
- Increasing and controlling film speed
- Controlling film thickness

Li purification by replacing impure Li inventory with fresh Li

Operating Parameters (for Li)

Stripper System Operating Parameter Envelope

Pressure Components	
Temperature	20° C to 350° C
Pressure	10 ⁻⁷ Torr to 700 psig
Max. Li inventory	0 to 3 liters
Vacuum Components	
Temperature	20° C to 450° C
Pressure	10 ⁻⁷ Torr to 8 psig
Max. Li inventory	0 to 3 liters



Zone 1

Tank filled with Li

Zone 2

Piping filled with Li

Zone 3

Empty vacuum chambers

Zone 4

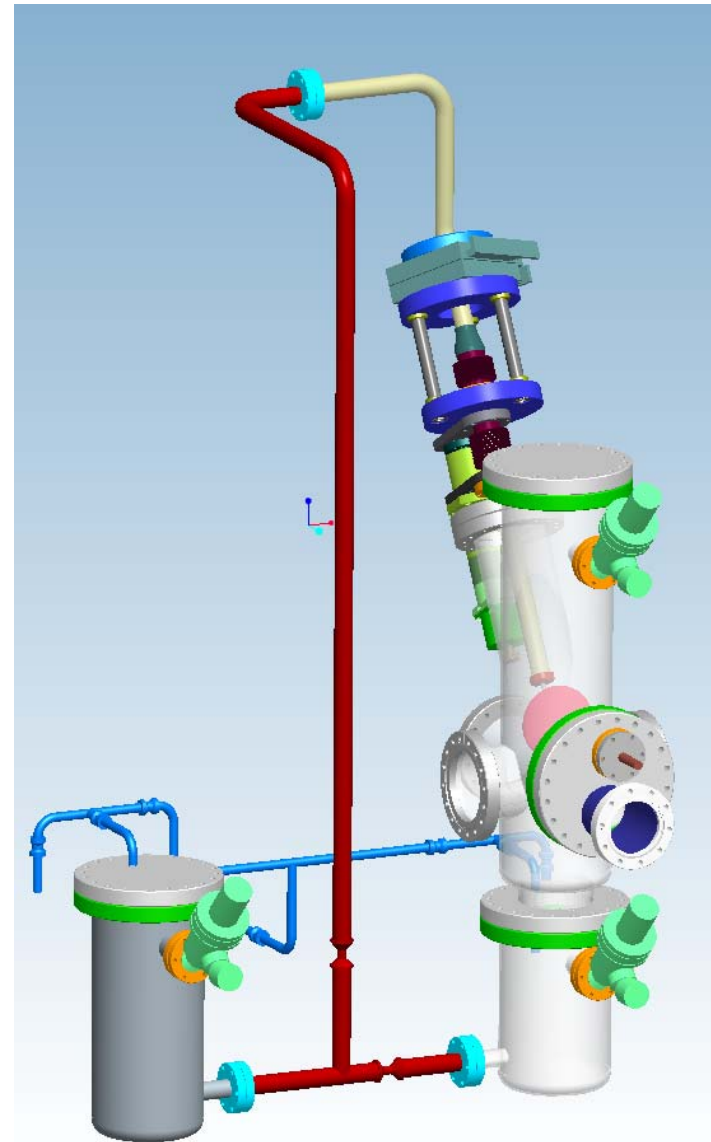
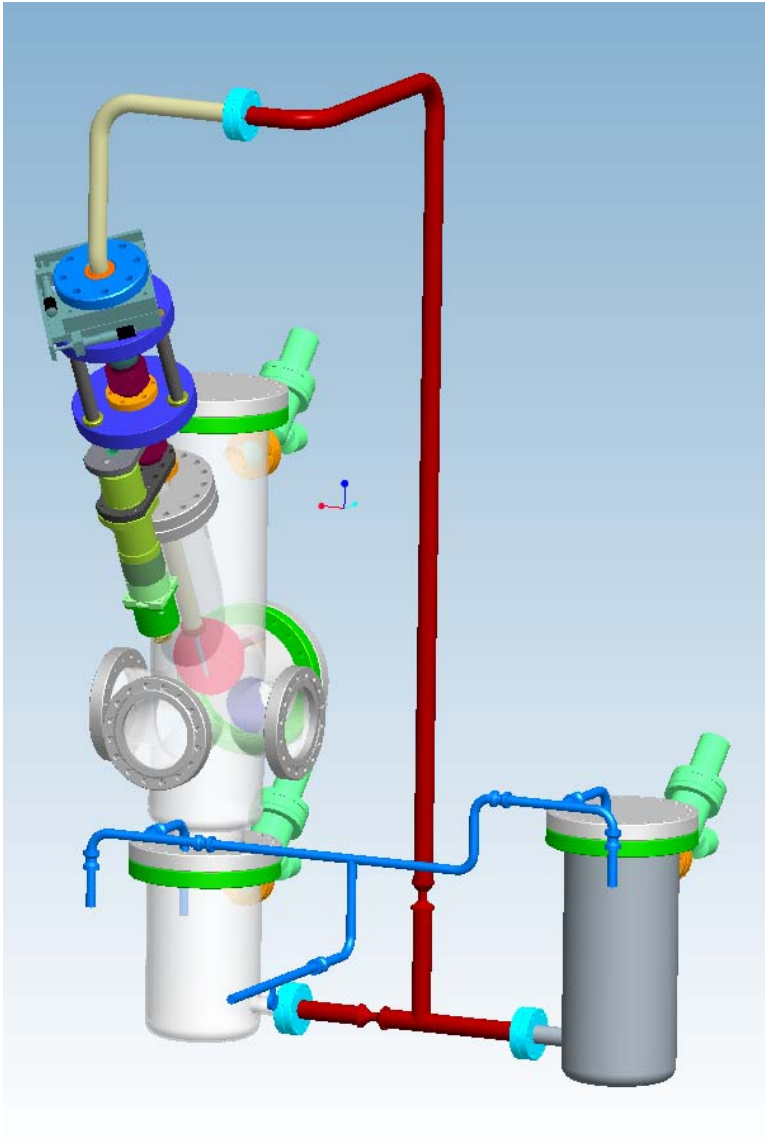
Flanges

Zone 5

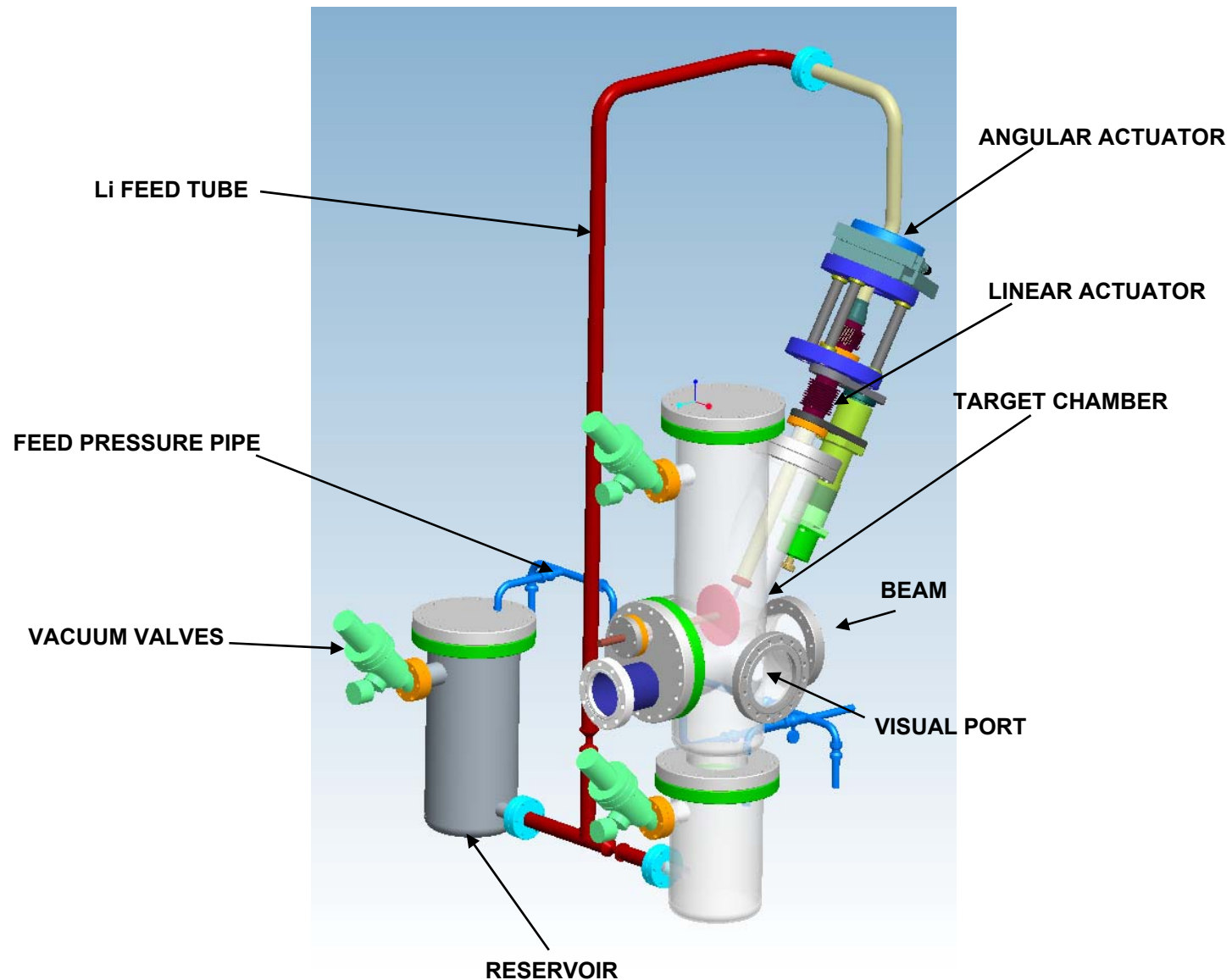
Nozzle control mechanism

Thin Film System Schematic and Heater Zones

Status of Drawings



Status of Drawings

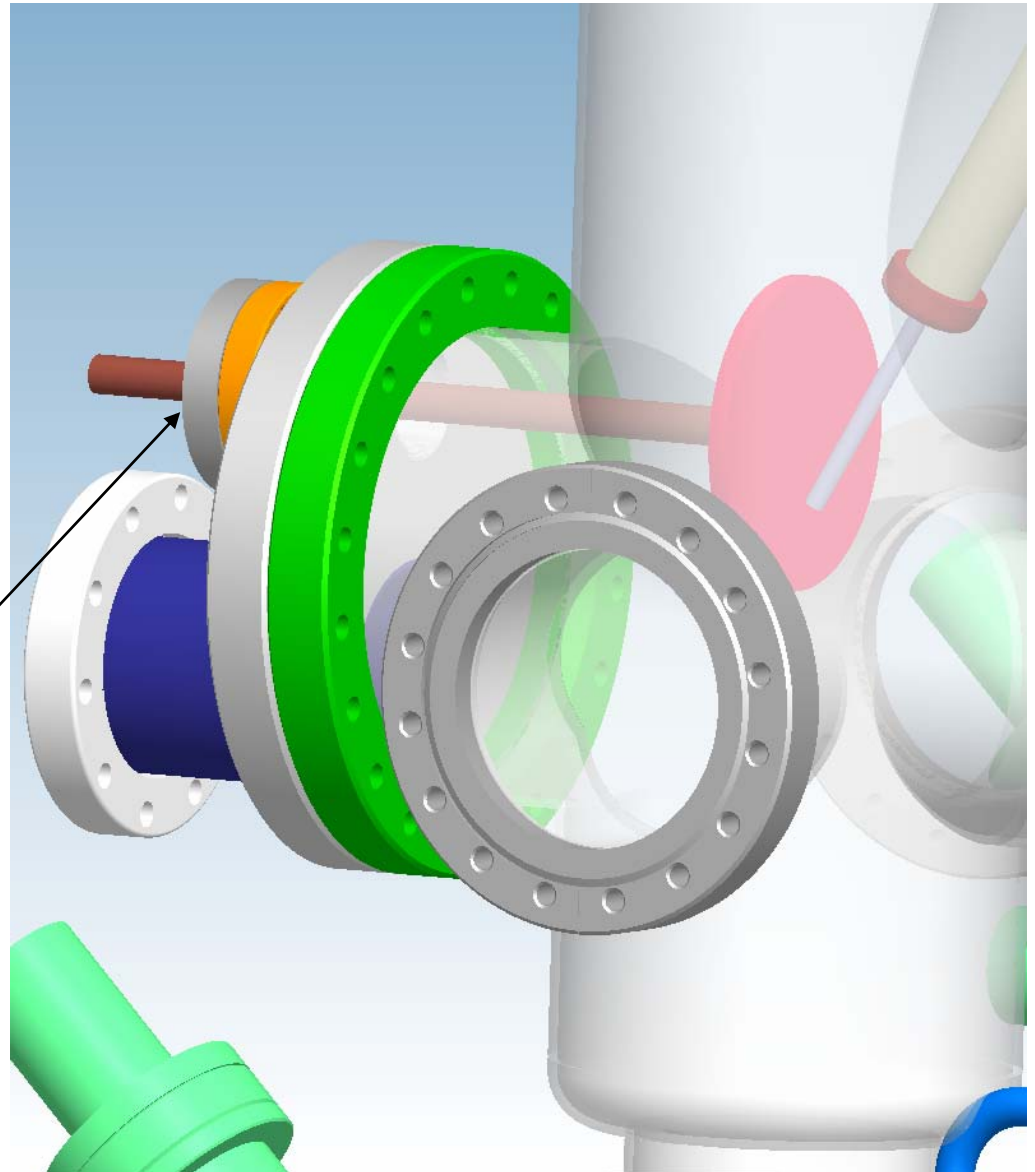
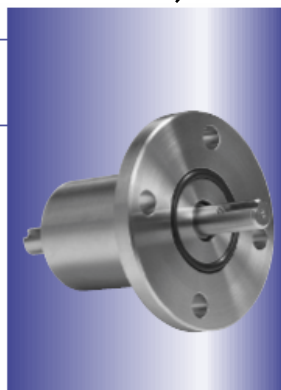
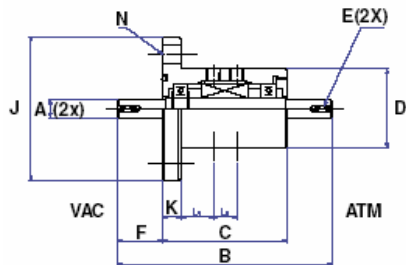


Status of Drawings

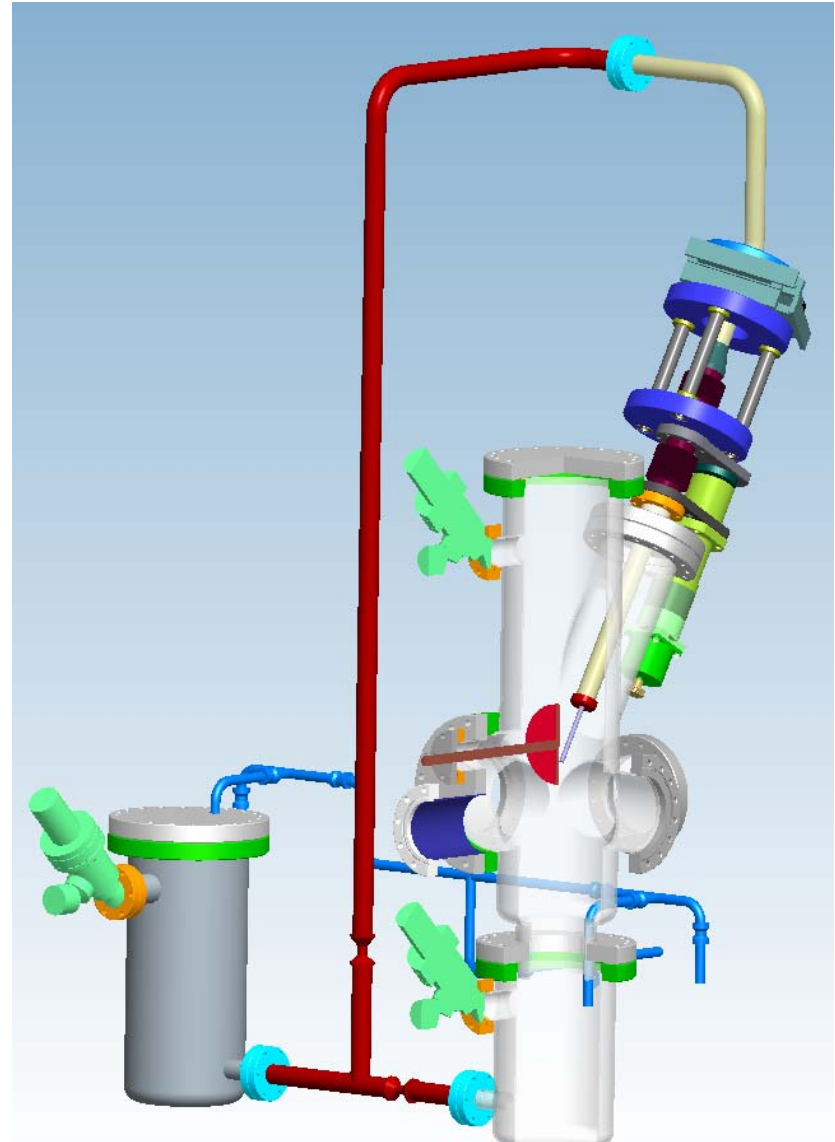
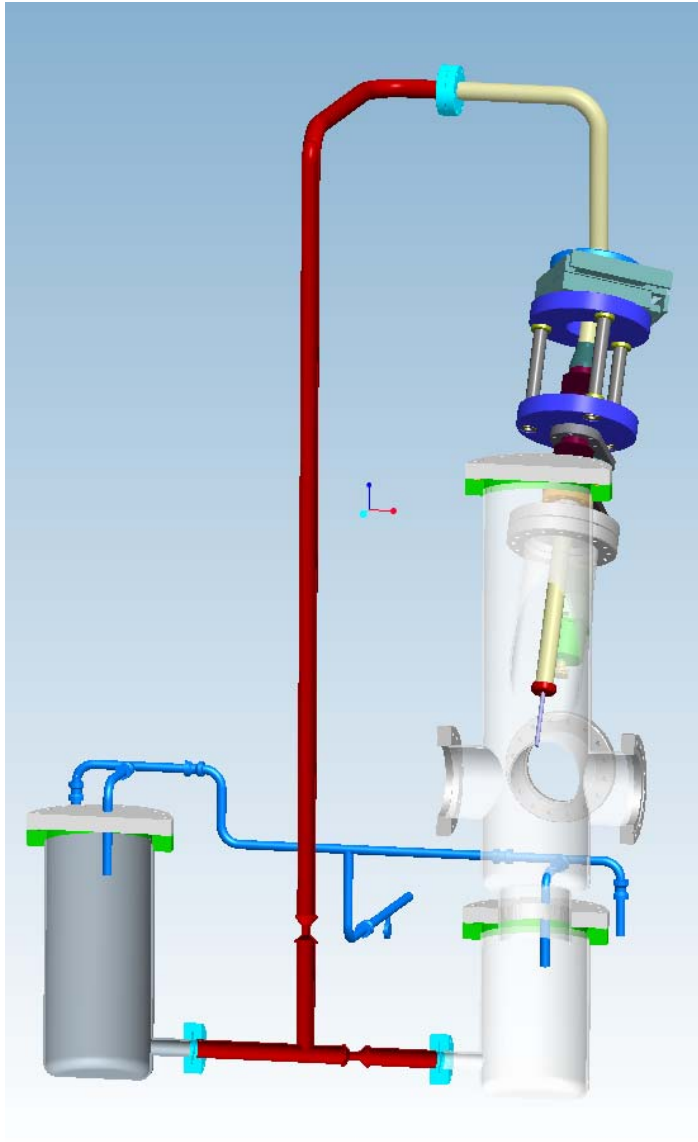
Ferrofluidic®
Vacuum
Rotary
Feedthroughs



Flange
Mount
Feedthroughs



Status of Drawings



Status of Procurements

- **Main Lithium System:**
 - 2 bellows sealed valves on order
- **Vacuum System:**
 - Four 4" gate valves on hand
 - Most piping & fittings on order



Status of Experimental Area in 370

- **Containment complete**
 - Structure
 - Floor
 - Lighting & electrical
- **Large diffusion pump**
 - In place
 - Wiring connected
 - Cooling water connection underway
 - Outgasing underway

Fabrication Outlook

- **Significant parts of nozzle positioning assy. on hand**
- **Long lead items on order:**
 - Bellows sealed Li valves
 - Vacuum piping
- **Other system components have short delivery times**
- **Designers will work closely with CS to expedite fabrication**

ES&H

- **LADD (Laboratory Activity Data Document)**
 - NE Division required
 - Prepared by Novick
 - Approved by Reed & Grandy
 - On second iteration
 - Resolving reviewer's comments
 - Better set of dwgs. (from this review) will help
- **Smoke detection & scrubber connected**
- **Occupancy permit for new containment**
 - Imminent